Public Report for ESA-075-3

Company	Rochelle Foods	**ESA Dates**	May 19-21, 2008
Plant	Rochelle plant	**ESA Type**	Compressed Air
Product	Food product	**ESA Specialist**	B. Gopalakrishnan, Ph.D., P.E., C.E.M.

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction: A three-day energy savings assessment (ESA) was performed at Rochelle Foods, 1001 S Main Street, Rochelle, IL. There are three 175-hp variable speed screw compressors (Table 1). The company has two day types: (a) production days as Monday-Saturday and (b) Sundays. The annual energy consumption by the compressors was estimated using profile data in AIRMaster+. The compressed air system was analyzed during this assessment and the potential annual savings in the electrical energy cost was estimated as 25.90% with respect to annual energy used to run the compressors. The potential energy and cost savings are 861,183 kWh/yr (equivalent to 2,939 MMBtu/yr) and $64,046/yr respectively.

Objective of ESA: Improve compressed air system efficiency and reduce the operating cost for the company.

Focus of Assessment: Compressed air system.

Approach for ESA: Apply technical expertise and DOE BestPractices software tool AIRMaster+.

General Observations of Potential Opportunities:

Impact electrical cost is $0.07437/kWh

Energy Saving Assessment Results
Rochelle Foods, 1001 S Main Street, Rochelle, IL 61068
May 19-21, 2008

This assessment consists of the application of AIRMaster+ developed by the US Department of Energy (USDOE), Industrial Technologies Program. The assessment consisted of training the plant personnel on the use of AIRMaster+ and the utilization of electrical and pressure data loggers for monitoring over an extended period of time. The data obtained from the compressors' display panel and the user's manual was also utilized. An ultrasonic air leak detector was used to identify compressed air leaks and a handheld pressure gage and power meter were used to obtain instantaneous pressure and power readings respectively. An air flow meter was used to estimate the amount of compressed air used in different applications. The 3-day assessment resulted in the following energy efficiency measures.

Recommendation 1: Reduce Air Leaks

A comprehensive study was performed to find compressed air leaks in the facility. An ultrasonic compressed air leak detector was used to identify the location of air leaks and quantify the energy and cost savings. The sample list of air leaks and the corresponding compressed air lost from the system are provided in Table 2. Based on the sample study, it is assumed that 75% of the leaks can be repaired with an ongoing leak management program. The energy and cost savings from this recommendation is estimated as 308,602 kWh/yr (or 1,053 MMBtu/yr) and $22,951/yr respectively. To the best of the specialist's knowledge, the implementation cost is estimated as $10,000 (includes the cost of an ultrasonic leak detector and labor and material cost to fix the leaks) with a simple payback of 0.4 years. The company is encouraged to make efforts to obtain more accurate implementation costs.

Recommendation 2: Improve End Use Efficiency

The major compressed air users in the plant are vacuum-packaging machines, nozzles for the product movement, foaming machines, and machine cylinders & actuators. The facility has several nozzles (approximately 100) in these areas that are used for moving the material from one place to the other place or for cleaning purposes. It was noted that these nozzles do not have the vortex design and hence use significant amount of compressed air. It is recommended to use vortex nozzles instead of regular nozzles wherever possible. Vortex nozzles reduce the compressed air demand to as low as $1/10^{th}$ of the current compressed air demand. It is expected that the installation of vortex nozzles will not only reduce the requirement but will help the compressors to operate at almost constant level for longer time and hence increasing the life of the compressors. It was estimated that by improving the end use efficiency, the compressed air requirement can be reduced by 150 cfm during Monday-Saturday and 75 cfm on Sundays. The energy and cost savings from this recommendation are estimated as 245,555 kWh/yr (or 838 MMBtu/yr) and $18,262/yr respectively. To the best of the specialist's knowledge, the implementation cost is estimated as $10,000 with a simple payback of 0.5 years. The company is encouraged to make efforts to obtain more accurate implementation costs.

Recommendation 3: Use Automatic Sequencer

This recommendation is based on the analysis of the compressors' power consumption and the amount of compressed air (acfm) generated on a typical day (Figures 1, 2, 3, and 4). Currently, the plant has three 175-hp variable speed screw type air compressors. It was observed that the system did not have any sequencer or cascading controls. It is recommended to install an automatic sequencer with the target pressure as 110±2 psig and operate only two compressors on Sundays. After the automatic sequencer is installed, it is expected that only the required compressors will operate and the others will be turned off because of the automatic shutdown timers. The energy and cost savings from this recommendation are estimated as 172,848 kWh/yr (or 590 MMBtu/yr) and $12,854/yr respectively (Note: these savings are adjusted to reflect the reduced savings as the compressors already have variable speed controls. Based on analysis of the literature, the savings are assumed to be 80% of that reported by the AIRMaster+ software). To the best of the specialist's knowledge, the implementation cost is estimated as $25,000 with a simple payback of 1.9 years. The company is encouraged to make efforts to obtain more accurate implementation costs.

Recommendation 4: Reduce System Air Pressure

Pressure data loggers were installed in five locations in the plant. The samples of compressed air pressure profile in the facility are shown in Figures 5 and 6. As seen from the pressure profiles, the compressed air pressure fluctuates between 101 psig and 125 psig. It is estimated that after changing the regular nozzles with vortex nozzles and reducing the compressed air leaks, the system set point can be reduced by at least 5 psig. The energy and cost savings from this recommendation are estimated as 134,178 kWh/yr (or 458 MMBtu/yr) and $9,979/yr respectively. To the best of the specialist's knowledge, the implementation cost is estimated as $2,000 (includes the time to do the system analysis and lower the system pressure in steps to make sure all the equipment operate properly) with a simple payback of 0.2 years. The company is encouraged to make efforts to obtain more accurate implementation costs.

Conclusion

The implementation of Recommendations 1 through 4 is likely to save approximately 130-hp of used compressor capacity for a typical production day operation. The current and modified hourly profile of power consumption and the compressed air generation after the first four recommendations are given in Figures 7 and 8.

Appendix: Table and Figures

Table 1: Compressor Inventory

Compressor	HP	Type	System
Comp # 1	175	Screw	Plant Air
Comp # 2	175	Screw	Plant Air
Big Atlas	175	Screw	Plant Air

Table 2: Compressed Air (cfm) Lost from the Leaks

Estimated cfm loss per leak	Number of Leaks

4.74	2
5.68	9
6.97	3
8.26	2

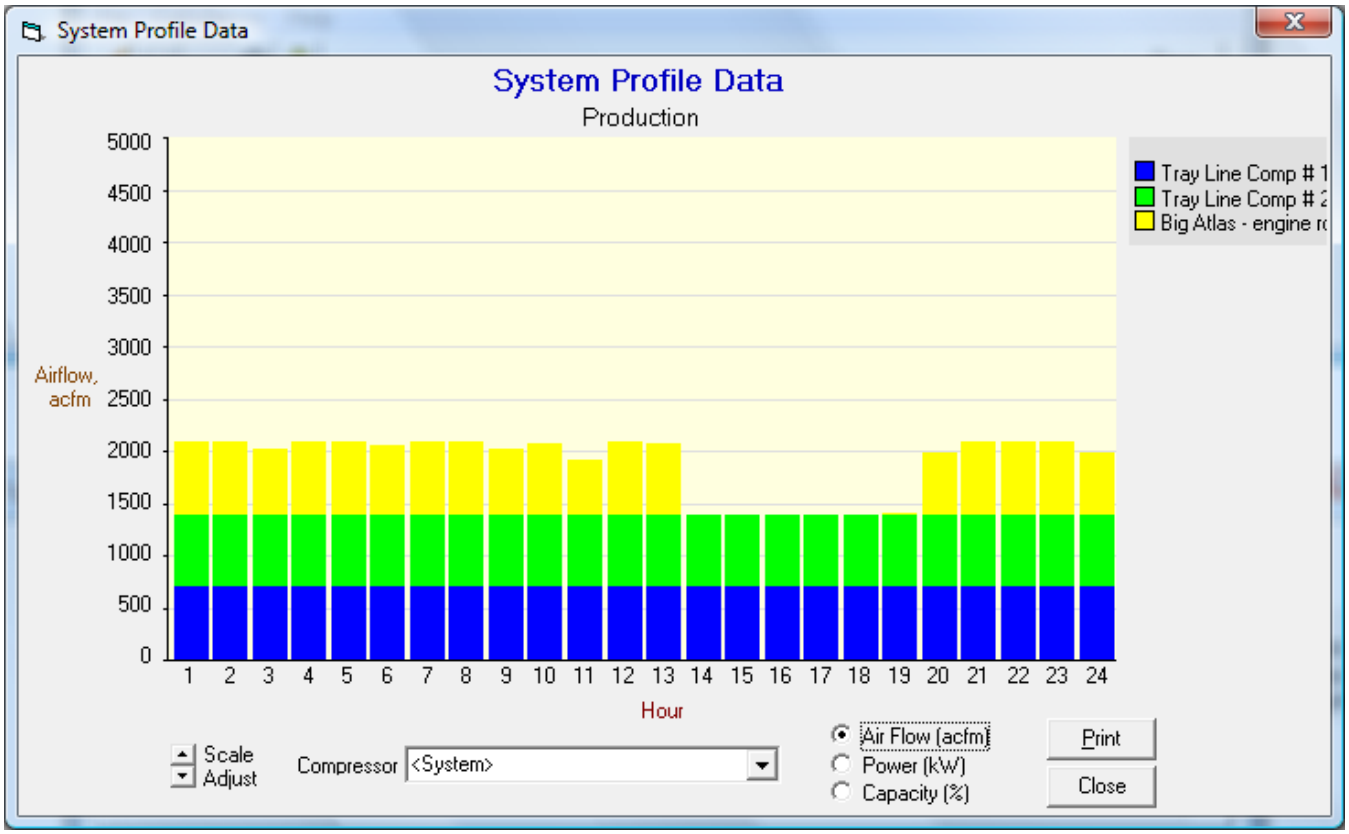

Figure 1: Hourly Profile of Generated Compressed Air, cfm (Monday-Saturday)

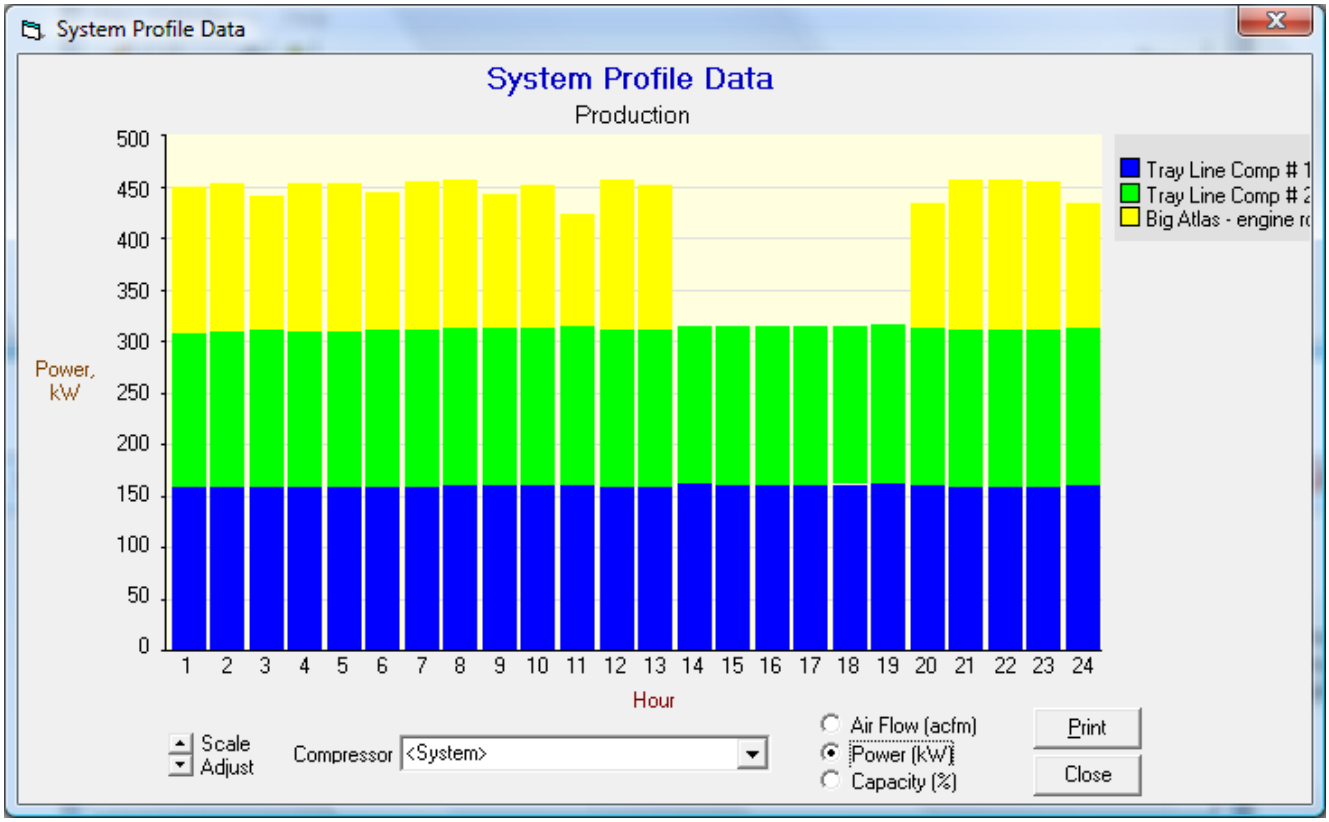

Figure 2: Hourly Profile of power consumption, kW (Monday-Saturday)

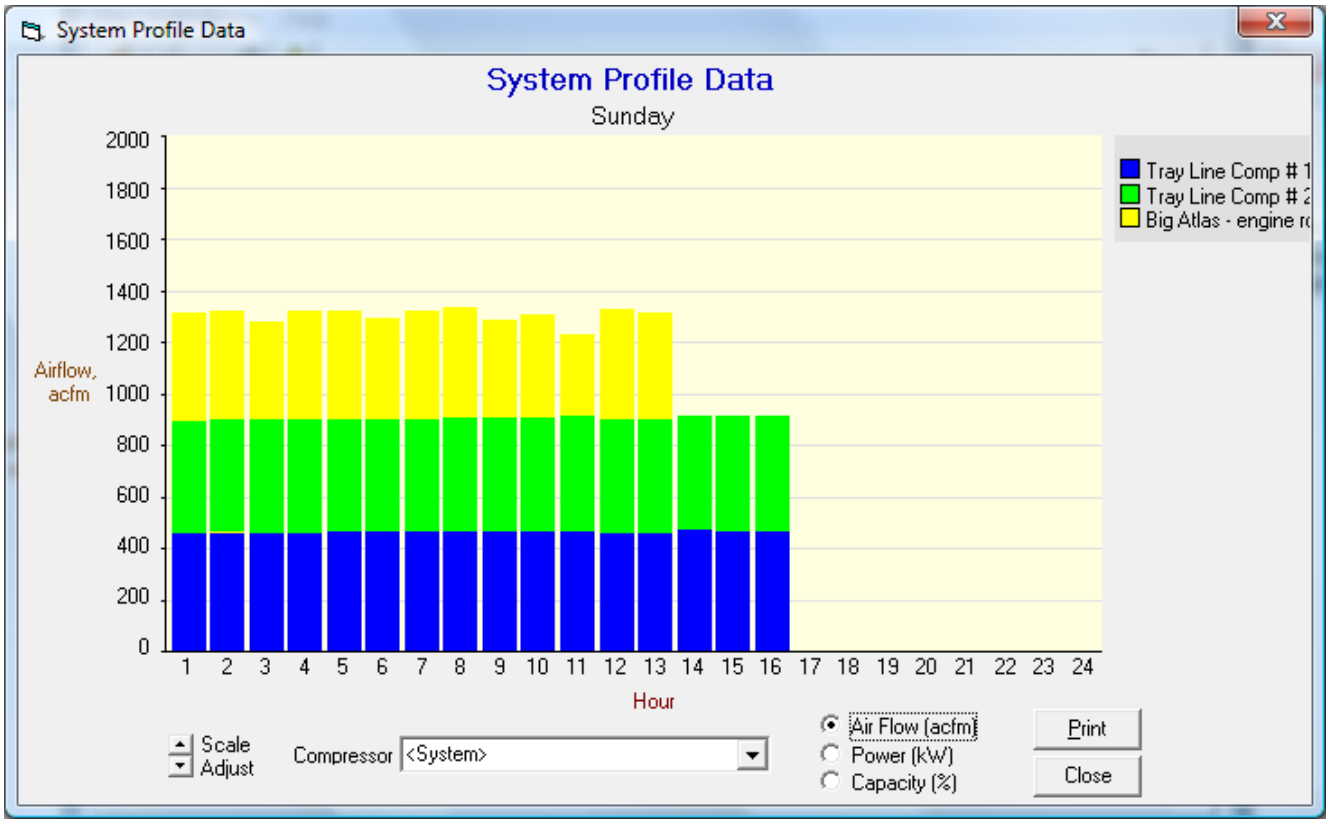

Figure 3: Hourly Profile of Generated Compressed Air, cfm (Sundays)

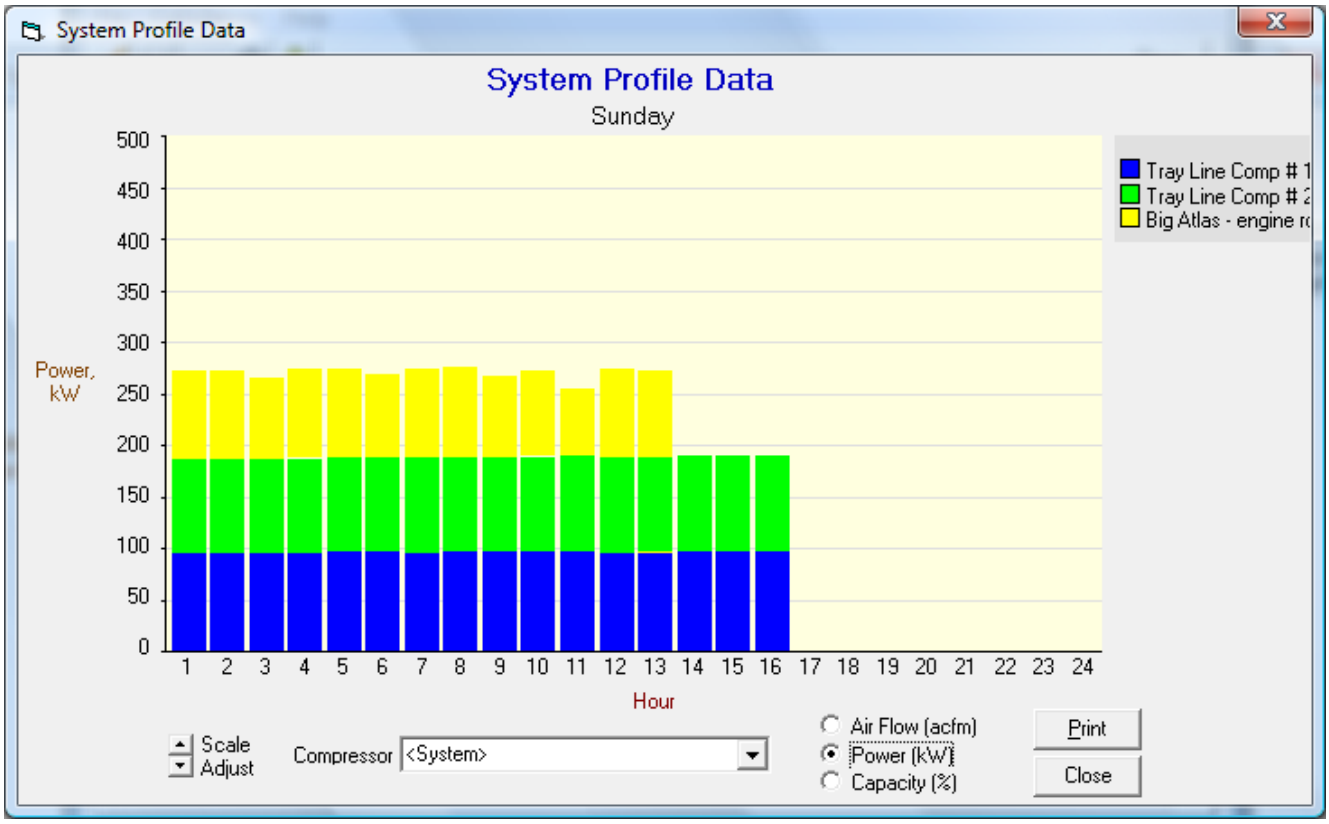

Figure 4: Hourly Profile of power consumption, kW (Sundays)

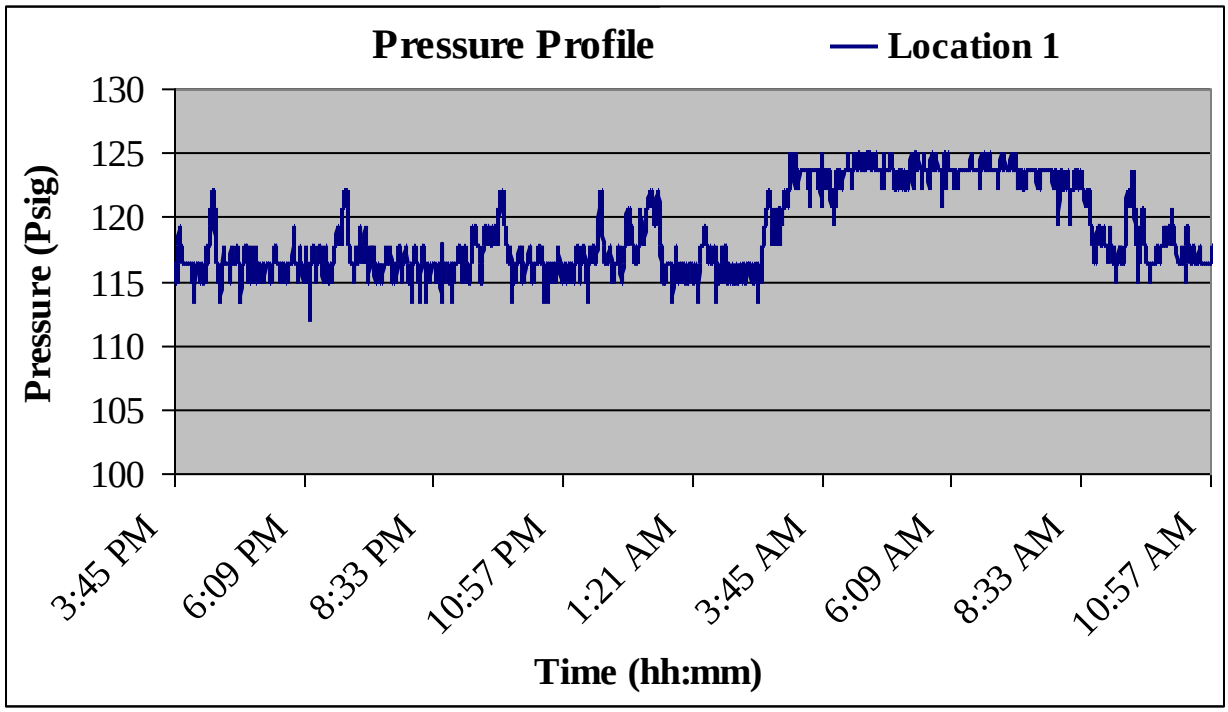

Figure 5: Pressure Profile Location 1 of the Plant

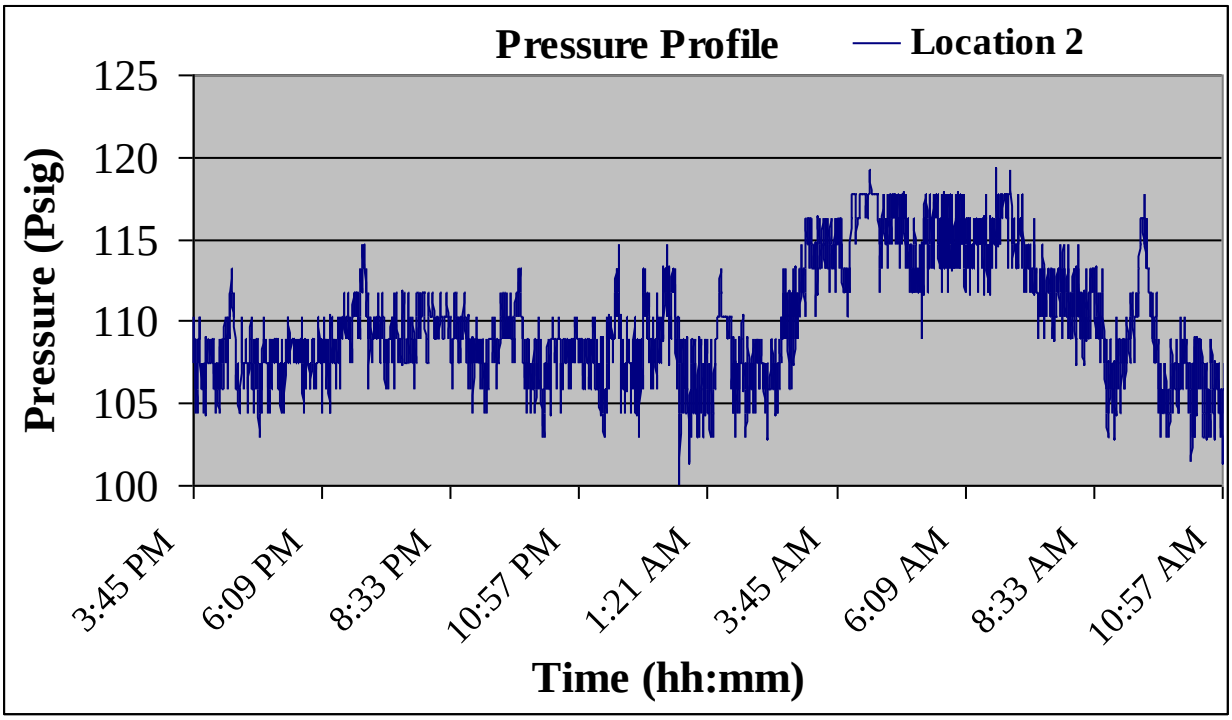

Figure 6: Pressure Profile Location 2 of the Plant

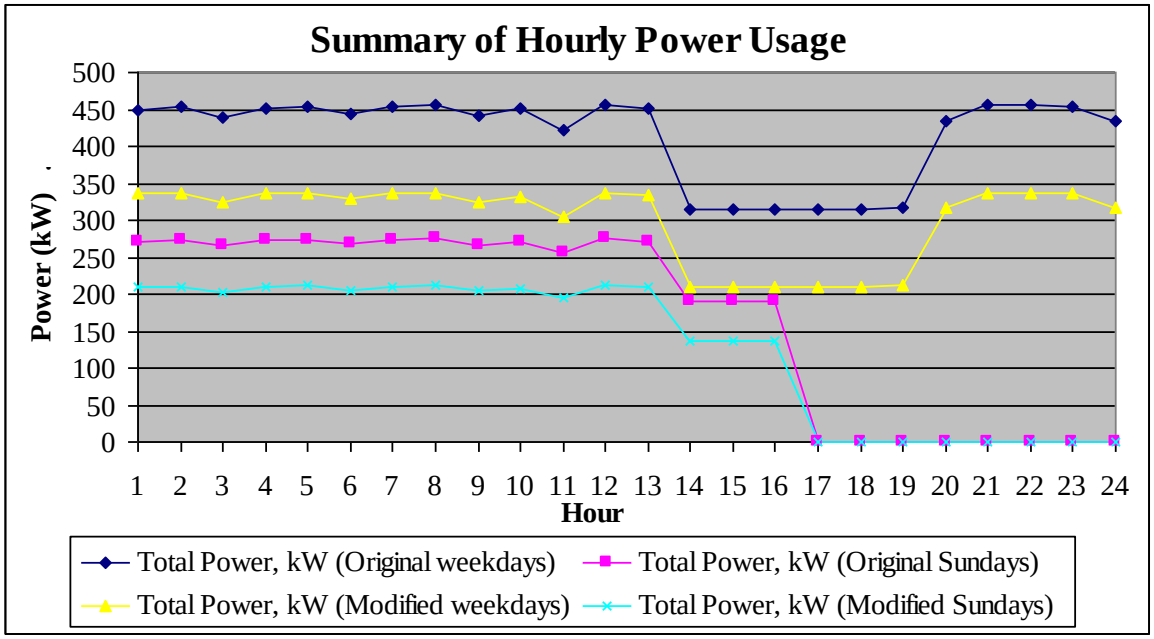

Figure 7: Hourly Profile of Power consumption

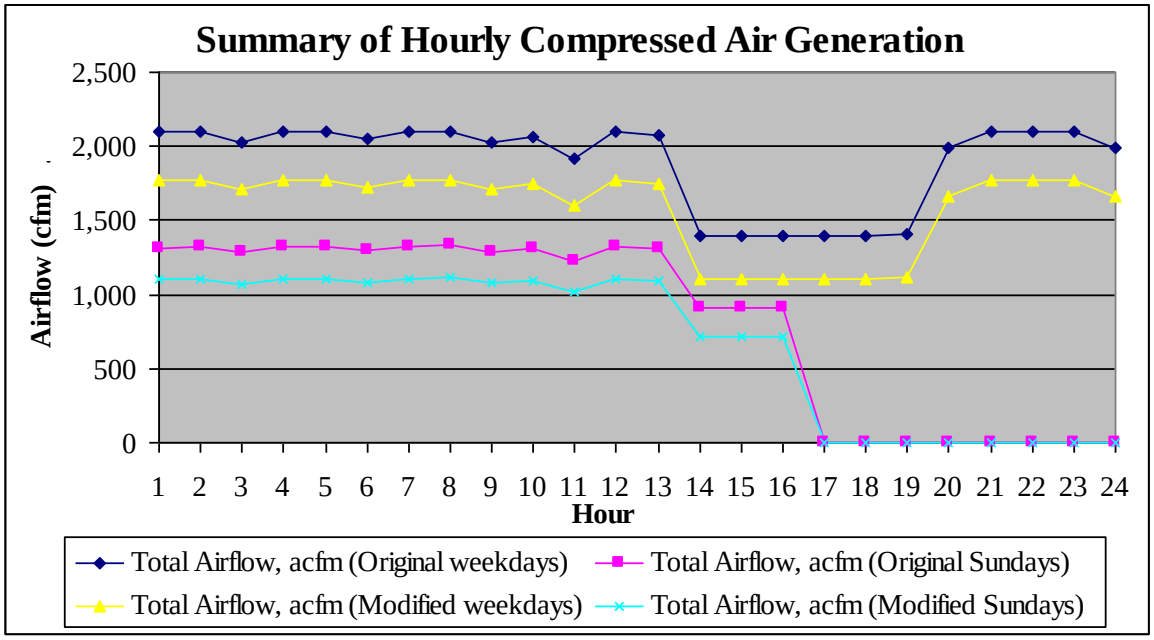

Figure 8: Hourly Profile of Compressed Air Generation

Management Support and Comments:

The management at the facility was very supportive and facilitated the productive completion of the assessment. The plant personnel were trained in the use of the AirMaster+ tool. The plant's contact persons, Mr. Ditto and Mr. Lutz were in agreement with the preliminary findings outlined in this report. The individual comments are summarized in the "Consensus Evaluation" file.

Disclaimer

The purpose of the energy assessment conducted by Pro-Plus Engineering, PLLC on contract with the US Department of Energy is to identify and quantify savings opportunities using prevailing engineering principles. While the preliminary recommendations in this report have been reviewed for technical accuracy, they are based on observed conditions and information obtained during the assessment. Actual savings will depend on many factors, including measures implemented, operating procedures and variations in fuel prices and weather. This report is not intended to provide detailed engineering plans or designs. Pro-Plus Engineering, PLLC does not make any warranty with respect to the accuracy, usefulness or completeness of the savings estimates or the contents of this report. For this reason, your organization is encouraged to carefully evaluate each opportunity and attain further engineering analysis, if desired, to verify or refine any savings estimates.

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